III. Inception of ITCT

The International Global Atmospheric Chemistry Project (IGAC) was established in response to the growing concern about the chemical changes in the global atmosphere, which are described above, and their potential impacts on humanity. The aims of IGAC are to:

- Develop a fundamental understanding of the processes that determine atmospheric composition.
- Understand the interactions between atmospheric chemical composition and biospheric and climatic processes.
- Predict the impact of natural and anthropogenic forcing of the chemical composition of the atmosphere.

At the inception of IGAC, it was recognized that the composition and chemistry of the atmosphere are dependent on climatic, ecological, geophysical and anthropogenic variables. A systematic study of the atmosphere must be able to account for the complex interactions among all these variables. However, over the globe these variables are strongly dependent on location. For these reasons, five major regions were defined as research foci: marine, tropical, polar, boreal and mid-latitude regions. Two of the activities established under the IGAC marine research focus were the North Atlantic Regional Experiment (NARE) and the East Asian/North Pacific Regional Experiments (APARE). The aim of these two research foci was to determine the influence that the industrial regions of continents that rim the North Atlantic and North Pacific have on the chemical composition of those marine atmospheres. Since its inception, NOAA has provided the leadership for the NARE activity.

Recently, IGAC re-focused its structure into three main subject areas: biosphere-atmosphere exchange, photochemistry, and atmospheric aerosols. In addition, IGAC has moved away from regional concepts toward a more global perspective. In this context, it was natural to coordinate the two IGAC regional activities concerned with photochemistry, NARE and APARE, within a single framework that has a global dimension (ITCT) and both gas-phase and particulate-phase science objectives.

The focus of ITCT is to investigate intercontinental transport of anthropogenic pollution and to determine the chemical transformations that occur during this transport. The investigation will be initially focused in the Northern Hemisphere that contains most of the world landmasses,

where most of the world's population resides, and where most of the anthropogenic pollution is generated. Four central research questions define the thrust of ITCT:

- **What are the export fluxes of anthropogenic pollutants from the northern mid-latitude continents (North America, Europe, Asia) to the global atmosphere?** Answering this question is critical for assessing the potential of anthropogenic emissions at northern mid-latitudes to affect global atmospheric chemistry. Emission inventories for major pollutants are generally available but need to be compared with atmospheric observations of export fluxes from the large-scale continental regions. These comparisons must be done in a way that accounts for changing emissions and for complications from chemistry and deposition taking place within the continental source regions.
- **What is the ultimate fate of northern mid-latitude pollutants exported to the global atmosphere?** This fate largely determines the global environmental implications of the pollutants. Long-range transport of pollution at northern mid-latitudes by the prevailing westerlies may affect surface air quality in continents downwind. Deposition to the oceans or to the Arctic may have important ecological implications, while transport to the tropics may be more important from a climatic standpoint. The task here is to better understand the dynamical and chemical evolution of polluted continental air masses in the global atmosphere.
- **How does intercontinental transport of pollution at northern mid-latitudes affect surface air quality?** Import of pollutants from continents upwind may compromise efforts of individual countries to reach air quality goals through domestic emission controls. The importance of international transport of pollution within a continent has long been recognized in this context. The question posed by ITCT is whether intercontinental transport of northern mid-latitude pollution needs to be accounted for as well. Quantifying both the chemical outflow and the chemical inflow for these large-scale source/receptor regions effectively frames the problem of constructing chemical budgets for these regions.
- **What are the implications for global atmospheric chemistry of rapid population growth and industrialization in the tropics?** The tropics will play a growing role in the future for the global budgets of anthropogenic pollutants. One needs to develop the tools to accurately track changing emission inventories, to quantify pollutant export fluxes from major tropical source regions, and to understand the underlying mechanisms. Compared to

northern mid-latitudes one may expect large and changing differences in the types of emissions as well as in the meteorological and photochemical environments that determine the export of pollution.

The stage for addressing these ITCT questions has been set by recent findings of IGAC-related research. Some of the findings within the framework of IGAC and their implications are described below.